

## TRANSMITTAL LETTER TO THE UNITED STATES

DESIGNATED/ELECTED OFFICE (DO/EO/US)

CONCERNING A FILING UNDER 35 U.S.C. 371

1048-3001 PCT/PTO 1 4 NOV 2001

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR

09/980659

INTERNATIONAL APPLICATION NO.  
PCT/JP00/00035INTERNATIONAL FILING DATE  
7 January 2000PRIORITY DATE CLAIMED  
9 June 1999

## TITLE OF INVENTION

HEATER WIRE FOR DEVICE SUCH AS IMPULSE SEALER

## APPLICANT(S) FOR DO/EO/US

SAKAMOTO, A., et al.

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (24) indicated below.
4. ☒ The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
  - a. ☒ is attached hereto (required only if not communicated by the International Bureau).
  - b. ☐ has been communicated by the International Bureau.
  - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
  - a. ☒ is attached hereto.
  - b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
  - a. ☐ are attached hereto (required only if not communicated by the International Bureau).
  - b. ☐ have been communicated by the International Bureau.
  - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
  - d. ☒ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
10. ☐ An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).
11. ☐ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☒ A copy of the International Search Report (PCT/ISA/210).

## Items 13 to 20 below concern document(s) or information included:

13. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☒ A **FIRST** preliminary amendment.
16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. ☐ A substitute specification.
18. ☐ A change of power of attorney and/or address letter.
19. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
20. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).
21. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
22. ☒ Certificate of Mailing by Express Mail
23. ☒ Other items or information:

Return receipt postcard

09/980659

PCT/JP00/00035

JC10 Rec'd PCT/PTO

0112893-005 14 NOV 2001

24. The following fees are submitted:

**BASIC NATIONAL FEE ( 37 CFR 1.492 (a) (1) - (5) ) :**

- ☐ Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO ..... \$1040.00
- ☒ International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO ..... \$890.00
- ☐ International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO ..... \$740.00
- ☐ International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) ..... \$710.00
- ☐ International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) ..... \$100.00

**ENTER APPROPRIATE BASIC FEE AMOUNT =****\$890.00**

Surcharge of \$130.00 for furnishing the oath or declaration later than months from the earliest claimed priority date (37 CFR 1.492 (e)).

☐ 20☐ 30**\$0.00**

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE
Total claims	12 - 20 =	0	x \$18.00
Independent claims	2 - 3 =	0	x \$84.00

**\$0.00****\$0.00**

Multiple Dependent Claims (check if applicable).

☐**\$0.00****TOTAL OF ABOVE CALCULATIONS =****\$890.00**☒ Applicant claims small entity status. See 37 CFR 1.27). The fees indicated above are reduced by 1/2.**\$445.00****SUBTOTAL =****\$445.00**

Processing fee of \$130.00 for furnishing the English translation later than months from the earliest claimed priority date (37 CFR 1.492 (f)).

☐ 20☐ 30**\$0.00****TOTAL NATIONAL FEE =****\$445.00**

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable).

☐**\$0.00****TOTAL FEES ENCLOSED =****\$445.00**Amount to be:  
refunded

\$

charged

\$

- a. ☒ A check in the amount of **\$445.00** to cover the above fees is enclosed.
- b. ☐ Please charge my Deposit Account No. \_\_\_\_\_ in the amount of \_\_\_\_\_ to cover the above fees. A duplicate copy of this sheet is enclosed.
- c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. **02-1818** A duplicate copy of this sheet is enclosed.
- d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

**NOTE:** Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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SIGNATURE

Robert M. Barrett

NAME

30,142

REGISTRATION NUMBER

November 14, 2001

DATE

**CERTIFICATE OF MAILING BY "EXPRESS MAIL" (37 CFR 1.10)**

Applicant(s): Sakamoto et al.

Docket No.

112895-005

Serial No.

09/980,659

Filing Date

November 14, 2001

Examiner

Unknown

Group Art Unit

Unknown

Invention: **HEATER WIRE FOR DEVICE SUCH AS IMPULSE SEALER**

I hereby certify that the following correspondence:

**Transmittal Letter (duplicate); Response to Notification of Missing Requirements; Preliminary Examination Report and Amended Claims (with English Translation); Two (2) Sheets of Translated Drawings; Verified Statement Claiming Small Entity Status; Executed Declaration and Power of Attorney; Copy of Notification of Missing Requirements; Check in the Amount of \$195.00; and Return Receipt Postcard.**

*(Identify type of correspondence)*

is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 in an envelope addressed to: The Assistant Commissioner for Patents, Washington, D.C. 20231 on

**April 4, 2002***(Date)***Robert J. Buccieri***(Typed or Printed Name of Person Mailing Correspondence)**(Signature of Person Mailing Correspondence)***EL 727 382 418 US***("Express Mail" Mailing Label Number)***Note: Each paper must have its own certificate of mailing.**

**VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY  
STATUS (37 CFR 1.9(f) AND 1.27 (b)) - INDEPENDENT INVENTOR**

Docket No.  
0112895-005

Serial No.  
PCT/JP00100035

Filing Date  
January 7, 2000

Patent No.

Issue Date

Applicant/  
Patentee: **Sakamoto, et al.**

Invention:

**HEATER WIRE FOR DEVICE SUCH AS IMPULSE HEAT SEALER**

As a below named inventor, I hereby declare that I qualify as an independent inventor as defined in 37 CFR 1.9(c) for purposes of paying reduced fees under section 41(a) and (b) of Title 35, United States Code, to the Patent and Trademark Office with regard to the invention entitled above and described in:

- ☐ the specification to be filed herewith.  
☒ the application identified above.  
☐ the patent identified above.

I have not assigned, granted, conveyed or licensed and am under no obligation under contract or law to assign, grant, convey or license, any rights in the invention to any person who could not be classified as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

- ☒ No such person, concern or organization exists.  
☐ Each such person, concern or organization is listed below.

\*NOTE: Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities (37 CFR 1.27)

FULL NAME

ADDRESS

☐ Individual ☐ Small Business Concern ☐ Nonprofit Organization

FULL NAME

ADDRESS

☐ Individual ☐ Small Business Concern ☐ Nonprofit Organization

FULL NAME

ADDRESS

☐ Individual ☐ Small Business Concern ☐ Nonprofit Organization

FULL NAME

ADDRESS

☐ Individual ☐ Small Business Concern ☐ Nonprofit Organization

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF INVENTOR Atsunobu Sakamoto

SIGNATURE OF INVENTOR Atsunobu Sakamoto

DATE: 11-28-01

NAME OF INVENTOR Kazuko Sakamoto

SIGNATURE OF INVENTOR Kazuko Sakamoto

DATE: 11-28-01

NAME OF INVENTOR \_\_\_\_\_

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DATE: \_\_\_\_\_

NAME OF INVENTOR \_\_\_\_\_

SIGNATURE OF INVENTOR \_\_\_\_\_

DATE: \_\_\_\_\_

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

#3/a

Applicant: SAKAMOTO, A., et al.

Appl. No.: PCT/JP00/00035

Filed: January 7, 2000

5 Title: HEATER WIRE FOR DEVICE SUCH AS IMPULSE SEALER

Art Unit: Unknown

Examiner: Unknown

Docket No.: 0112895-005

10 Assistant Commissioner for Patents

Washington, DC 20231

**PRELIMINARY AMENDMENT**

Sir:

15 Please amend the above-identified patent application as follows:

**In the Specification:**

**SPECIFICATION**

**TITLE OF INVENTION**

20 HEATER WIRE FOR DEVICE SUCH AS IMPULSE SEALER

**BACKGROUND OF THE INVENTION**

The present invention relates to an impulse sealer, a book binding machine and a laminator which thermally melts and adheres material such as polyethylene.

**Background Art**

25 An impulse heat sealer causes a current of 8-15A to flow through a heater wire having a width of about 2-5mm, heats the heater wire to about 150°C for a short period of time, about one second, and melts and adheres polyethylene and thermally meltable resin. With regard to the heater wire, a heat generating portion therefor uses a narrow width wire member having a high electrical resistance such as iron chromium and  
30 nichrome, and an electrode portion which requires no heat generation uses such as a

comparatively thick plated copper plate and iron plate, and the both are connected, such as by press contacting and spot welding.

Although a large current flows through the sealer, since the length of the sealer is about 20-40 cm, a voltage which appears at the both ends thereof merely reaches to about 15-30V. For this reason, the commercial power source voltage of 100-220V had to be adjusted by making use of a voltage regulator such as a transformer and an electronic circuit.

Since the press contacting and the spot welding of the heater wires is manual work which requires human senses, it may cause irregular lengths of the heater wires, defective products and lack of accuracy, and that tends to cause overheating of the connected portion and shortening the lifetime of the heater wires.

Further, the electrode, which is press contacted and spot welded has a substantial thickness, the thick electrode portion could not be mounted on a heater stand, therefore, when a conventional expansion absorbing device 15 as shown in Fig. 5 is used and the heat generation portion is extended, both ends thereof float in the air and are overheated, therefore, it has frequently happened that holes are caused in the polyethylene over the over heated portions.

Further, the transformer is very heavy, and with regard to the voltage regulator in the form of the electronic circuit since the voltage thereof is comparatively low in comparison with the power source voltage and the current thereof is large, the control of the voltage regulator is difficult and fault likely occurs, and further the prices of these two components are high.

In the book binding machine and the laminator, a metallic bar and a roll having a large thermal capacity are heated by a heater which is formed by winding a nichrome wire around a mica plate and is used under a thermal equilibrium state. Even if the amount for processing is slight, there is a waiting period of 5 to 10 minutes until the metallic bar or the roll are heated.

A prior art of the present invention, JP(U)-A-57-167004 (herein below will be referred to as citation) discloses a zigzag shaped heater wire which is formed by cutting slits on a tape shaped metallic layer pasted on a glass epoxy resin substrate from both sides thereof alternatively in perpendicular direction to its longitudinal direction, and of which configuration is very similar to the present invention.

However, the objects of the citation are to prevent braking of the heater wire due to force of a thermal expansion use spring, to eliminate a transformer by narrowing a broad width heater wire and to enhance heat dissipation property. The prior art, however, is silent to eliminate the zigzag shape on a seal line by decreasing a gap of the respective slits and never refers to such an object.

With regard to the gap size, the citation indicates that the gap size is about three times larger than the thickness of the metallic layer. Since the thickness thereof in an embodiment of the citation is 0.1mm, the gap will be 0.3mm, but an iron chrome thin plate with no tempering having a thickness of 0.1mm cannot maintain its given shape. The heater wire's shape, according to the present invention, can be maintained without trouble. An experiment was performed thereon in such a manner that while covering a teflon coated glass tape of 0.1mm over the thus produced heater wire, the heater wire was heat sealed according to the embodiment of the citation, however, gaps clearly appeared on a seal line. If a metallic wire with no tempering is used, thickness of 0.2mm is required, then according to the citation the gap will amount to 0.6mm in such instance the gaps will clearly appear on the seal line.

Therefore, the disclosure in the citation, "the seal width is 5mm corresponding to the width of rectangular pulse wave as shown in Fig. 1," likely possibly suggests that the seal line is in a zigzag shape as it is. However, if the gaps on the seal line disappear, it is presumed that such will be caused by the heat accumulated therearound including a substrate, because the citation indicates that the scaling time is 4 seconds which is 4-8 times longer than a sealing time of 0.5-1 second of a usual sealer, on one hand it is presumed that such is because of poor heat dissipation which is contrary to the original object of the citation, regardless the citation nowhere suggests that the gaps should be limited as much as possible.

Further, in the citation, it is necessary to keep the shape of the metallic plate by adhering the same on a glass epoxy resin substrate, however, in order to reduce cost in mass production with regard to metallic portions, photo exposure and etching is performed over a broad area, therefore, the citation raises problems and includes unsolved problems as follows. How the glass epoxy resin substrate is cut? Whether the heat resisting property of the epoxy resin substrate can be maintained because the operation temperature of the sealer for such as PP rises to more than 150°C? What



sort of adhesives having durability is used? Whether the heat dissipation property due to the closely contacted substrate is deteriorated as referred to above? Whether the sealing time is prolonged because of the heat absorption by the substrate? How the both ends of the lead wire portion can be taken out to the outside in a flat state because the both ends of the lead wire portion also serve as the pressing faces?

#### SUMMARY OF THE INVENTION

A heater wire is formed in such a manner that a thin plate of resistance material, such as iron chromium, is further thinned by rolling, and is properly strengthened, such as by tempering, thereafter the same is processed by photo-etching then the width of electrode portion a portion which is required to suppress heat generation is broadened so far as permitted; a heat generating portion is shaped into a desired configuration with a narrow uniform width, then both portions are integrated.

Further, a measure is applied to the electrode portion which eliminates the drawback of swelling in a seal line.

The heater wire is formed in a zigzag shape of narrow uniform width over the entire desired configuration of the heat generation portion which causes gaps in the formed seal line or plane to disappear due to the heat diffusion from the heater wire.

Still further, by making use of the heater wire, an impulse-type book binding machine and laminator may be produced in which heating is performed instantaneously to melt an adhesive on an inside resin and then interrupts the current supply to cool the same.

Additional features and advantages of the present invention are described in, and will be apparent from, the following Detailed Description of the Invention and the Figures.

#### BRIEF DESCRIPTION OF THE FIGURES

Figs. 1 through 3 are plane views of embodiments of heater wires of the present invention and embodiments of seal lines in the formed melting and adhering traces through sealing.

Fig. 4 is a side view showing an expansion absorbing structure of a heater wire caused by itself.

Fig. 5 is a side view of a conventional expansion absorbing structure.

Figs. 6 and 7 are plane views showing application embodiments of the heater wire of the present invention.

Fig. 8 is a plane view showing an embodiment of heater wires of the present invention for a bag with a cat pattern.

Fig. 9 is a plane view showing a zigzag shaped heater wire and the seal line formed thereby.

Figs. 10 through 12 are enlarged plane views of heat generating portions thereof.

Fig. 13 is a plane view showing another heater wire.

Fig. 14 is a plane view showing a connecting portion with a heater wire.

#### DETAILED DESCRIPTION OF THE INVENTION

Fig. 1 is a plane view of a heater wire 1 and its seal line 2 in an example of the present invention. The heater wire 1 includes a heat generating portion 3 having a width of 2mm and electrode portions 4 having widths of 5mm which are formed from a same plate member by photo etching in such a manner that on a thin plate which is formed by rolling an iron chromium material into 0.1mm and is adjusted into a proper hardness a photosensitive material is coated in advance, after photo-masking a pattern the coated photosensitive material is exposed and fixed, thereafter, further covering a necessary portion with a film and dissolving and removing unnecessary portions by acid to complete the same. In the electrode portions of the present invention even if a same resistance material is used, when the width of the electrode portions is broadened more than about two times, it can be controlled and no sealing is effected at the portions.

When the heater is used for household use in which the number it is used is small, no problems occur, however, when the heater is used continuously, the heat in the heat generating portion gradually spreads into the electrode portions 4, swellings 5 are formed in the seal line 2 of the heater wire 1 due to the width expansion of the electrode portions 4 at both ends thereof. If a force applied to a bag is concentrated onto the swelling 5, the seal is likely broken. There are three countermeasures therefor.

The first countermeasure is to place heat absorbing electrode plates 6 at the positions of the electrode portions 4 so as to overlap therewith, as shown in Fig. 2,

thereby, the heating is stopped at their overlapping portions as shown by the seal line 7, the heat absorbing electrode plate 6 which is disclosed in Japanese Patent Application No. Heiseil 8-346654 is a thin plate of alloy materials having good electrical and, in particular, thermal conductive property such as nickel plated phosphate bronze. Drawbacks of this measure are the increase in the number of parts correspondingly and, because of current flow between the heat generating portions 3 and the heat absorbing electrode plates 6, to consume the heater wire comparatively rapidly at their contacting portions.

A second countermeasure is, in order to prevent swelling of the seal line at the side of the bag main body, either to offset the heat generating portion 3 from the center, to eliminate the width broadened portion 8 at the side of the bag main body and to double the width at the opposite side or as shown in Fig. 3 to retreat the width broadened portions near both ends, as illustrated, in comparison with the width broadened portion 9 at the opposite side, which forms the side of the bag edges. In this instance, although the swelling 11 on the seal line is formed, it only appears at the side of the bag edges. The above indication at the sides of the bag main body and at the bag edges is, of course, only one of the standards which implies that the swellings are aligned at one side where the adversary influence is small.

The same effect can be obtained if the heater wire 1 is bent perpendicularly along the broken lines 12 as in Fig. 3. This is for preventing unnecessary elongation of the sealer. When the electrode portion 4 is bent perpendicularly as illustrated by the side view in Fig. 4, a pillow shaped projection 14 is placed before the fixing screw 13 to apply a tension thereto, the elongation of the heat generating portion caused during the heating is sufficiently absorbed by the electrode portion through the spring property of itself, thereby; the conventional complex elongation absorbing device having many parts is unnecessitated.

The heat generating portion 3 can be formed in any shape other than a straight line. An elliptical heater wire 16 as shown in Fig. 6 is for a molding handle of a polyethylene shopping bag and a rectangular heater wire 17 as shown in Fig. 7 is for sealing an outer frame of a bag shaped filter. Further, the heater wire 17 is required to form a closed space by the rectangular seal line, therefore, if the gap at a nearby portion 18 is set below 0.2mm, the gap on the seal line will disappear.

Such relationship between gap and seal line occurs in any heater wire. Fig. 8 shows heaters for a shopping bag with an inflatable cat head which is used through experience for a balloon manufacturing method disclosed in U.S. Patent No. 5,545,117, wherein a heater wire 20 of nichrome round wire is for sealing and burning off the outer configuration, a heater wire 21 is for sealing in order to separate the cat head from the inside of the shopping bag and copper wires are connected along dotted portions 22 at both ends thereof so as to prevent heat generation. The heater is formed in such a manner that after arranging these round wires into a desired configuration, these are fixed by fluoro resin coated glass cloth with adhesive to fix the same. The cat face and the handle are illustrated to facilitate understanding of the above explanation.

At this instance, at the portions where the two heater wires come most close, in the two portions at the root portion of ear and jaw portion, it is necessary to keep air tight, therefore, the heater wire 21 is closely contacted at the portions by adhering a glass tape having thickness of about 0.1mm but electrically insulating one portion from the other. Because of adhering the tape at the portions, the sealing temperature tends to be lower, however, since the heater wires are closely located, much tendency is cancelled out, further, through controlling the supply current, the above arrangement is operated sufficiently and it was found out that no air leakage gap was formed in the resultant seal line.

A heater wire which makes use of the above arrangement is one shown in Fig. 9, in which the width of the resistance material is narrowed and fine slits are cut in a heat generating portion 23 to form a uniform zigzag in perpendicular direction in the longitudinal direction thereof, and Figs. 10 through 12 are partially enlarged views thereof. When these heater wires are used and if the slits are sufficiently small, a beautiful single seal line 24 as illustrated can be obtained. Further, the zigzag is interrupted immediately before the electrode portions at the both ends and is restored to the original width. No problematic end swellings appear on the seal line 24, which is the third countermeasure.

The resistance value of the zigzag shaped heater wire is about  $25\Omega$  wherein fine slits of about 0.2mm are cut on the heat generating portion 23 with an interval of about 0.4mm in a zigzag manner, on the other hand, an electrical resistance of a heater

wire having the width of 2mm and length of 200mm which forms the same seal line as above is  $2\Omega$ . Therefore, in the electrical point of view, the latter conventional heater wire requires about 16V and 8A, on the other hand the heater wire of the present invention forming the same seal line as the conventional one requires a high voltage of 50V and a low current of 2A.

If the commercial source voltage is 100V, it can be applied only by subjecting the same to halfwave rectification, further if the length of the heater wire is prolonged to 1.4 times to 280mm, the commercial source voltage of 100V can be directly applied to the heater wire. Still further, if the commercial source voltage is 200V, when the length of the heater wire is prolonged to two times, the commercial source voltage is applicable to the heater wire after subjecting the same to halfwave rectification, however, when the width of the heater wire is modified to 3mm and the length thereof is prolonged in total to three times, the commercial source voltage of 200V can be applied as it is, thereby a transformer and a voltage regulating circuit can be completely omitted.

Since the zigzag shaped heater wire of the present invention is fixed while minimally expanded, the expansion and contraction due to heat can be absorbed by the heater wire itself, the conventional complex expansion absorbing device as shown in Fig. 5 is unnecessitated as well as the simple device as shown in Fig. 4.

The reason how the gaps disappear from the seal line when the heater wire includes the gaps is that the heat generated is transferred toward the gaps via the covering fluoro resin coated glass tape and the polyethylene film itself to be sealed. Therefore, if the usual thickness of 0.1 - 0.2mm is further thickened or the generated thermal amount and the generating time are increased, the gaps on the seal line will disappear even if the gap is more than 0.2mm. Further, the gap of less than 0.1mm is, of course, preferable, however, the mass production using etching will become difficult. Within the defined range, a gap having a taper as shown in Fig. 11 is acceptable.

Further, it is permitted to modify the width of the heater wire, since the heat generation amount is anti-proportional to the width, through combinations with the gaps, heaters having a variety of effects can be manufactured. For example, as shown in Fig. 12, although the heater has the same or the substantially the same configuration

with regard to sealing, the temperature distribution thereof is varied in such a manner that at the center portion in the width of the heat generating portion is set high and the surrounding portion thereof is set lower, thereby possible edge cutting can be prevented. In fact, since heat generating density is also anti-proportional to the interval of the gaps, the same effect as increasing the taper of the gaps in the heater wire as shown in Fig. 11 can be obtained.

With an annealed material such as iron chromium material and nichrome alloy, a heater wire having width of even 2mm is soft and deforms during treatment thereof, if the thickness thereof is not about 0.2mm. However, these days a thin plate having thickness of 0.1mm can be manufactured by an economical rolling and when the thin plate is strengthened through a proper degree of quenching, a heat generating portion having a zigzag in the interval of 0.4mm as referred to above shows a sufficiently practical strength. However, if the tempering is too strong, the zigzagged heat generating portion is likely to break, therefore, the quenching amount has to be proper.

Since the operating temperature of the heater wire is below 200°C and is far below the quenching temperature of more than 600°C, no tempering occurs due to the heating. Further, other than the tempering a strengthening processing such as reforming by means of such as rolling and forging can be applied. To sum up, with regard to thickness of the heater wire, the thinner, the better so long as the strength thereof can be supplemented such as by tempering. The zigzag direction in the longitudinal direction as shown in the plan view in Fig. 13 can be used, however, since each zigzag length is longer, a further higher mechanical strength is required. Accordingly the strength thereof depends on the properness of its configuration design. Further, in the case of the heater having a broad area as shown in Fig. 13, any manner of covering the area with the wires and gaps are permitted and the zigzag shapes as defined in the claims cover all of these zigzag shapes. Further, other than the zigzag shape defined only by straight lines, zigzag shapes defined by curved lines are also included and, other than the heat generating wire itself of straight line any shapes of heat generating wires, such as a curved one and one having different widths can be used.

Further, as processing methods thereof, wire cutting and laser cutting can be used. Although a heater wire is not an expensive article, a transformer can be omitted

by modifying the processing of the heater wire, the heater wire can be manufactured in view of the saved cost of omitting the transformer. Accordingly, although the etching is a very economical method, the present invention is not limited thereto. Other than the zigzag shaped heat generating portion 23 formed integral with the electrode portion 4, as shown in the plan view in Fig. 14 the present invention includes an arrangement in which the zigzag portion is connected via a width broadened connecting portion 25 to the electrode portion 4 through spot welding.

Further, the sealer pressing mechanism of the present invention includes a pressing operation via a worker wherein the worker grips a T shaped hand type handle being provided with a heater at one side thereof by the hand and performs heat sealing by pressing the same on polyethylene placed on a work stand. Further, since the present heater can be operated while omitting the voltage regulator, the power source circuit implies a simple current supply from the power source to the heater. Further, since the impulse sealer of the present invention is lightweight and can be directly coupled to a power source, the present impulse sealer can be actively used in a field where only heating plate type heaters are conventionally used.

The above can also be applied to a book binding machine and a laminator using such heating plate type heater and the impulse heat sealer of the present type can be applied therefor. Namely, a fluoro resin tape is covered on a zigzag shaped heater wire which is shaped into a necessary configuration, with a press mechanism incorporating the same such as a bundle of paper for book binding and laminated films are pressed, a comparatively large current is fed thereto for a short time to heat the same and is interrupted to cool the same, thereby an adhesive of such as heat meltable resin is melted and adhered. For example, since the zigzag shaped heater wire can be shaped in a rectangular shape, such heater wire is suitable for laminating a photo for an identification card. Such heater can be used any time when desired, moreover, such heater is not required to be always heated which contributes to energy saving. The heating equipment such as the impulse heat sealer as defined in the claims includes the above referred to a book binding machine and laminator.

#### Industrial Applicability of the Invention

According to the present invention, since the heater wires can be formed by making use of photoetching, heater wires of any configurations can be manufactured

accurately in large amount and with low cost, in addition, causes of shortening life time of the heater wire such as overheating due to poor spot welding is eliminated.

Since the electrode portions are formed thin as the heat generating portion, the electrode portions can be extended over on the heater stand, the undesirable formation of penetration holes on a processing subject due to overheating because of the floating in air of a part of the heat generating portion which likely happens at both ends of the conventional extension absorbing device is prevented.

Further, since the zigzag shape of the heater wire is formed with narrow slits which cause to disappear the slit gaps on the seal line, the voltage to be applied to the heat generating portion can be approximated to the voltage of the power source, thereby, a voltage regulator such as a transformer is unnecessitated and the structure thereof is simplified. Because the heavy transformer is omitted, the weight of the present device becomes very light and the cost thereof is lowered.

Further, since a possible distortion due to thermal expansion can be absorbed by the spring property of the heater wire itself and the zigzag shaped heat generating portion further enhances the distortion absorbing effect, thereby, the extension absorbing devices which usually have to be provided at the both ends of the heater wire can be simplified or unnecessitated.

Thus, the impulse heat sealer itself can be easily manufactured and the cost thereof can be lowered extremely.

Further, by making use of the heater wire of the present invention, an impulse heat sealer type book binding machine and laminator can be manufactured, and the present heater wire can be used instantly which contributes to energy saving.

Although the present invention has been described with reference to specific embodiments, those of skill in the art will recognize that changes may be made thereto without departing from the spirit and scope of the invention as set forth in the hereafter appended claims.



## ABSTRACT

A heater wire which is applied to an impulse heat sealer, a book binding machine, a laminator, an image-creating device, and so on. A thin sheet of resistant material such as iron-chromium alloy is further thinned by rolling, properly strengthened by quenching, and processed by photo-etching so that the width of a heat-generating part is small and those of the electrodes are larger than that, thus integrally producing a heater wire. The heat-generating part of the heater wire is zigzag at such small intervals that the zigzag pattern disappears on a sealing line or plane because of heat diffusion, and the width of the zigzag is uniformly narrow and almost equal to that of the required shape. Therefore, the drawback on connection between the heat-generating part and electrodes is solved and the resistant wire is matched with the power supply voltage because of its relatively fine and long structure.

### In the Claims:

Please amend Claims 1-5, as follows:

The invention is claimed as follows:

1. (Amended) An impulse heat sealer comprising:

a power source circuit, a heater connected thereto and a press mechanism incorporating the heater, wherein by feeding a comparatively large current from the power source circuit for a short time to the heater including a heater wire, the heater wire being covered by a fluoro resin coated glass tape, to heat the heater and by interrupting the comparatively large current for cooling, polyethylene and a heat meltable resin caught in the press mechanism is melted and adhered; and

the heater wire comprising a thin plate of electrically high resistance metal, the thin plate of electrically high resistance metal is thinned and strengthened, and the heater wire is processed in such a configuration that the width of an electrode portion or a portion which suppresses heat generation is broadened so far as permitted by the electrically high resistance metal, and a heat generating portion is shaped into a desired configuration with a narrow uniform width, then the both portions are integrated so as to form a self independent body.

2. (Amended) An impulse heat sealer according to Claim 1, wherein the heater wire, in order to prevent swelling of a seal line or a plane to a side of a main body of a polyethylene bag caught in the press mechanism and the breakage thereof should be prevented, is configured in such a manner that either the width broadened portion of the electrode portions at the side facing to the main body is eliminated or when the broadened portions are provided at both sides of the electrode portions, the broadened portions facing the main body is retreated further away in comparison with another broadened portion at the opposite bag edge side.

3. (Amended) An impulse heat sealer according to Claim 1, wherein the heat generating portions of a single or a plurality of heater wires are arranged to come close within a plurality of small gaps of certain degree formed by itself or with the other heater wires to gather the heat generated together through heat diffusion at a resultant seal line or a plane to disappear the gaps.

4. (Amended) An impulse heat sealer according to Claim 1, wherein the heater wire is configured in a zigzag shape with a small gap which is caused to disappear through heat diffusion on a resultant seal line or a plane, and is spread over a desired configuration for the heat generating portion.

5. (Amended) A book binding machine and laminator comprising:

a power source circuit, a heater connected thereto and a press mechanism incorporating the heater, the heater including a heater wire covered by a fluoro resin coated glass tape;

the heater wire comprising a thin plate of electrically high resistance metal, the thin plate of electrically high resistance metal is thinned and strengthened, the heater wire is processed to form an electrode portion or a portion which suppresses heat generation having a broadened width so far as permitted by the electrically high resistance metal and a heat generating portion formed into a zigzag shape with a narrow uniform width and with a small gap which disappears heating unevenness at a resultant sealed portion through heat diffusion and covering over an entire desired configuration thereof; and

the heater is heated by being fed a comparatively large current from the power source for a short time and is cooled by interrupting the comparatively large current, and using polyethylene and a heat meltable resin caught in the press mechanism as adhesive such as book binding use paper sheets and laminate use films are melt-adhered.

Please add newly submitted Claims 6-12, as follows:

6. An impulse heat sealer according to Claim 1, wherein the thin plate of electrically high resistance metal is thinned by a rolling means.

7. An impulse heat sealer according to Claim 1, wherein the thin plate of electrically high resistance metal is strengthened by a tempering means.

8. An impulse heater sealer according to Claim 1, wherein the heater wire is processed by a photoetching means.

9. An impulse heater sealer according to Claim 1, wherein the thin plate of electrically high resistance metal is iron chromium.

10. A book binding machine and laminator according to Claim 5, wherein the thin plate of electrically high resistance metal is thinned by a rolling means.

11. A book binding machine and laminator according to Claim 5, wherein the thin plate of electrically high resistance metal is strengthened by a tempering means.

12. A book binding machine and laminator according to Claim 5, wherein the thin plate of electrically high resistance metal is iron chromium.

## REMARKS

This Preliminary Amendment is submitted in the above-identified patent application. Pursuant to the Preliminary Amendment Claims 1-5 have been amended and newly submitted Claims 6-12 added. This Preliminary Amendment does not add new matter. Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned **"Versions with Markings to Show Changes Made."**

Respectfully submitted,

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## VERSION WITH MARKINGS TO SHOW CHANGES MADE

### In the Specification:

### SPECIFICATION

#### TITLE OF INVENTION

5 HEATER WIRE FOR DEVICE SUCH AS IMPULSE SEALER

#### BACKGROUND OF THE INVENTION

The present invention relates to an impulse sealer, a book binding machine and a laminator which thermally melts and adheres material such as polyethylene.

#### Background Art

10 An impulse heat sealer ~~is caused~~causes ~~to flow~~ a current of 8-15A to flow through a heater wire having a width of about 2-5mm, heats the heater wire to about 150°C for a short period of time, about one second, and melts and adheres polyethylene and thermally meltable resins, ~~and with~~ With regard to the heater wire, a heat generating portion therefor uses a narrow width wire member having a high  
15 electrical resistance such as iron chromium and nichrome, and an electrode portion which requires no heat generation uses such as a comparatively thick plated copper plate and iron plate, and the both are connected, such as by press contacting and spot welding.

Although a large current flows through the sealer, since the length of the sealer  
20 is about 20-40 cm, a voltage which appears at the both ends thereof merely reaches to about 15-30V. For this reason, the commercial power source voltage of 100-220V had to be adjusted by making use of a voltage regulator such as a transformer and an electronic circuit.

Since ~~such as~~ the press contacting and the spot welding of the heater wires is a  
25 manual work which requires human senses, ~~and it may causes~~ irregular lengths thereof of the heater wires, defective products and lack of accuracy, and ~~which that~~ tends to cause overheating of the connected portion and shortening the lifetime thereof of the heater wires.

Further, the electrode, ~~such as~~ which is press contacted and spot welded has a  
30 substantial thickness, the thick electrode portion could not be mounted on a heater stand, therefore, when a conventional expansion absorbing device 15 as shown in Fig.

5 is used and the heat generation portion is extended, ~~the~~ both ends thereof float in the air and are overheated, therefore, it ~~is~~ has frequently ~~happened~~ happened that holes are caused in ~~such as~~ the polyethylene over the over heated portions.

Further, the transformer is very heavy, and with regard to the voltage regulator  
5 in the form of the electronic circuit since the voltage thereof is comparatively low in comparison with the power source voltage and the current thereof is large, the control ~~thereof of the voltage regulator~~ is difficult and fault likely occurs, and further the prices of these two components ~~were~~ are high.

In ~~such as~~ the book binding machine and the laminator, ~~such as~~ a metallic bar  
10 and a roll having a large thermal capacity are heated by a heater which is formed by winding a nichrome wire around ~~such as~~ a mica plate and ~~are~~ is used under a thermal equilibrium state ~~thereof~~. ~~Therefore, even~~ Even if the amount for a processing is slight, it ~~there is required to~~ is required to a waiting period ~~for from~~ of 5 to 10 minutes until the metallic bar or the roll are heated.

As ~~a~~ prior art of the present invention, JP(U)-A-57-167004 (herein below will be referred to as citation) ~~is located~~. The citation discloses a zigzag shaped heater wire which is formed by cutting slits on a tape shaped metallic layer pasted on a glass epoxy resin substrate from both sides thereof alternatively in perpendicular direction to its longitudinal direction, and of which configuration is very similar to the present  
15 invention. However, the objects of the citation are to prevent braking of the heater wire due to force of a thermal expansion use spring, to eliminate a transformer by narrowing a broad width heater wire and to enhance heat dissipation property. and The prior art, however, is silent to eliminate the zigzag shape on a seal line by decreasing a gap of the respective slits and never refers to such an object.

With regard to the gap size, the citation indicates that the gap size is about  
25 three times larger than the thickness of the metallic layer. Since the thickness thereof in an embodiment of the citation is 0.1mm, the gap will be 0.3mm. ~~Although~~ but an iron chrome thin plate with no tempering having a thickness of 0.1mm cannot maintain ~~of its given shape~~. ~~However, since~~ The heater wire's shape, according to the present  
30 invention, ~~the shape~~ can be maintained without trouble. An experiment was performed thereon in such a manner that while covering a teflon coated glass tape of 0.1mm over the thus produced heater wire, the heater wire was heat sealed according

to the embodiment of the citation, however, gaps clearly appeared on a seal line. If a metallic wire with no tempering is used, thickness of 0.2mm is required, then according to the citation the gap will amount to 0.6mm in such instance the gaps will ~~further~~ clearly appear on the seal line.

5 Therefore, the disclosure in the citation, “the seal width is 5mm corresponding to the width of rectangular pulse wave as shown in Fig. 1,” likely possibly suggests that the seal line is in a zigzag shape as it is, ~~however~~ However, if the gaps on the seal line disappear, it is presumed that such will be caused by the heat accumulated therearound including a substrate, because the citation indicates that the scaling time is  
10 4 seconds which is 4-8 times longer than a sealing time of 0.5-1 second of a usual sealer, on one hand it is presumed that such is because of a poor heat dissipation which is contrary to the original object of the citation, ~~anyway~~ regardless the citation nowhere suggests that the gaps should be limited as much as possible.

Further, in the citation, it is necessary to keep the shape of the metallic plate by  
15 adhering the same on a glass epoxy resin substrate, however, in order to reduce cost in mass production with regard to metallic portions, photo exposure and etching is performed over a broad area, therefore, the citation raises ~~a lot of~~ problems and includes unsolved problems as follows. How the glass epoxy resin substrate is cut? Whether the heat resisting property of the epoxy resin substrate can be maintained  
20 because the operation temperature of the sealer for such as PP rises to more than 150°C? What sort of adhesives having durability is used? Whether the heat dissipation property due to the closely contacted substrate is deteriorated as referred to above? Whether the sealing time is prolonged because of the heat absorption by the substrate? How the both ends of the lead wire portion can be taken out to the outside  
25 in a flat state because the both ends of the lead wire portion also serve as the pressing faces?-

#### SUMMARY OF THE INVENTION

A heater wire is formed in such a manner that a thin plate of resistance material, such as iron chromium, is further thinned ~~extremely by means of such as~~  
30 rolling, and is properly strengthened, such as by tempering, thereafter the same is processed ~~such as by photo-photo-~~ etching, then the width of electrode portion a portion which is required to suppress heat generation is broadened so far as permitted; a heat

generating portion is shaped into a desired configuration with a narrow uniform width, then ~~the~~ both portions are integrated.

Further, a measure is applied to the electrode portion which eliminates ~~a~~ the drawback of swelling in a seal line.

5        ~~Further, the~~ The heater wire is formed in a zigzag shape of narrow uniform width over the entire desired configuration of the heat generation portion ~~while using small~~ which causes gaps which in the formed seal line or plane to disappear due to the heat diffusion from the ~~formed seal line or plane~~ heater wire.

10       Still further, by making use of the heater wire, an impulse--type book binding machine and laminator ~~are~~ may be produced in which heating is performed instantaneously to melt an adhesive on an inside resin and then interrupts the current supply to cool the same.

15       Additional features and advantages of the present invention are described in, and will be apparent from, the following Detailed Description of the Invention and the Figures.

#### BRIEF DESCRIPTION OF THE FIGURES

Figs. 1 through 3 are plane views of ~~a variety~~ embodiments of heater wires of the present invention and ~~of a variety~~ embodiments of seal lines in ~~that~~ the formed melting and adhering traces through sealing.

20       ~~Fig. 4 is a side view showing an expansion absorbing structure of a heater wire caused by itself.~~

~~Fig. 5 is a side view of a conventional expansion absorbing structure.~~

~~Figs. 6 and 7 are plane views showing application~~ examples-embodiments of the heater wire of the present invention.

25       ~~and~~ Fig. 8 is a plane view showing an embodiment of heater wires of the present invention for a bag with a cat pattern.

Fig. 9 is a plane view showing a zigzag shaped heater wire and the seal line formed thereby.

30       ~~Fig. 10 through 12 are enlarged plane views of heat generating portions thereof.~~

~~Fig. 13 is a plane view showing another heater wire, and~~

Fig. 14 is a plane view showing a connecting portion with a heater wire.



## DETAILED DESCRIPTION OF THE INVENTION

Fig. 1 is a plane view of a heater wire 1 and its seal line 2 in an example of the present invention. The heater wire 1 includes a heat generating portion 3 having a width of 2mm and electrode portions 4 having widths of 5mm which are formed from a same plate member by photo etching in such a manner that on a thin plate which is formed by rolling an iron chromium material into 0.1mm and is adjusted into a proper hardness a photosensitive material is coated in advance, after photo-masking a pattern the coated photosensitive material is exposed and fixed, thereafter, further covering a necessary portion with a film and dissolving and removing unnecessary portions by acid to complete the same. As in the present the electrode portions of the present invention even if a same resistance material is used, when the width of the electrode portions is broadened more than about two times, it can be controlled and no sealing is effected at the portions.

When the heater is used for household use in which the number of its is used is small, no problems occur, however, when the heater is used continuously, in a certain extent the heat in the heat generating portion gradually spreads into the electrode portions 4, swellings 5 are formed in the seal line 2 of the heater wire 1 due to the width expansion of the electrode portions 4 at both ends thereof. If a force applied to a bag is concentrated on-to the swelling 5, the seal is likely broken. There are three countermeasures therefor.

The first countermeasure is to place a heat absorbing electrode plates 6 at the positions of the electrode portions 4 so as to overlap therewith, as shown in Fig. 2, thereby, the heating is stopped at their overlapping portions as shown by the seal line 7, the heat absorbing electrode plate 6 which is disclosed in Japanese Patent Application No. Heisei 8-346654 is a thin plate of such as nickel plated phosphor bronze and alloy materials having good electrical and, in particular, thermal conductive property such as nickel plated phosphate bronze can be used therefor. Drawbacks of this measure are to the increase in the number of parts correspondingly and, because of current flow between the heat generating portions 3 and the heat absorbing electrode plates 6, to consume the heater wire comparatively rapidly at their contacting portions.

A second countermeasure is, in order to prevent swelling of the seal line at the side of the bag main body, either to offset the heat generating portion 3 from the center, to eliminate the width broadened portion 8 at the side of the bag main body and to double the width at the opposite side or as shown in Fig. 3 to retreat the width broadened portions near to the both ends, as illustrated, in comparison with the width broadened portion 9 at the opposite side, which forms the side of the bag edges. In this instance, although the swelling 11 on the seal line is formed, ~~which it~~ only appears at the side of the bag edges. The above indication ~~of~~ at the sides of the bag main body and ~~of~~ at the bag edges is, of course, only one of the standards which implies that the swellings are aligned at one ~~w~~side where the adversary influence is small.

The same effect can be obtained if the heater wire 1 is bent perpendicularly along the broken lines 12 as in Fig. 3. This is for preventing unnecessary elongation of the sealer. When the electrode portion 4 is bent perpendicularly as illustrated by the side view in Fig. 4, a pillow shaped projection 14 is placed before the fixing screw 13 to apply a tension thereto, the elongation of the heat generating portion caused during the heating is sufficiently absorbed by the electrode portion through the spring property of itself, thereby; the conventional complex elongation absorbing device 15 having many parts is unnecessitated.

The heat generating portion 3 can be formed in any shapes other than ~~the a~~ straight line. An elliptical heater wire 16 as shown in Fig. 6 is for a molding handle of a polyethylene shopping bag and a rectangular heater wire 17 as shown in Fig. 7 is for sealing an outer frame of a bag shaped filter. Further, the heater wire 17 is required to form a closed space by the rectangular seal line, therefore, if the gap at a nearby portion 18 is set below 0.2mm, the gap on the seal line will disappear.

Such relationship between gap and seal line occurs in any heater wires. Fig. 8 shows heaters for a shopping bag with an inflatable cat head which is used through experience for a balloon manufacturing method disclosed in U.S. Patent No. 5,545,117, wherein a heater wire 20 of nichrome round wire is for sealing and burning off the outer configuration, ~~likely,~~ a heater wire 21 is for ~~simply~~ sealing in order to separate the cat head from the inside of the shopping bag and copper wires are connected along dotted portions 22 at both ends thereof so as to prevent heat generation. The heater is formed in such a manner that after arranging these round

wires into a desired configuration, these are ~~caught-fixed~~ by ~~such as a~~ fluoro resin coated glass cloth with adhesive to fix the same. The cat face and the handle are illustrated to facilitate understanding of the above explanation.

At this instance, at the portions where the two heater wires come most close, in  
5 ~~that at the~~ two portions at the root portion of ear and jaw portion, it is necessary to keep air tight, therefore, the heater wire 21 is closely contacted at the portions by adhering ~~such as a~~ glass tape having thickness of about 0.1mm but electrically insulating one portion from the other. Because of adhering the tape at the portions, the sealing temperature tends to be lower, however, since the heater wires are closely located,  
10 much tendency is cancelled out, further, through controlling the supply current, the above arrangement is operated sufficiently ~~practical~~ and it was found out that no air leakage gap was formed in the resultant seal line.

A heater wire which makes use of the above arrangement is one shown in Fig. 9, in which the width of the resistance material is narrowed and fine slits are cut in a  
15 heat generating portion 23 to form a uniform zigzag in perpendicular direction in the longitudinal direction thereof, and Figs. 10 through 12 are partially enlarged views thereof. When these heater wires are used and if the slits are sufficiently small, a beautiful single seal line 24 as illustrated can be obtained. Further, the zigzag is interrupted immediately before the electrode portions at the both ends and is restored  
20 to the original width, ~~no~~ No problematic end swellings appear on the seal line 24, which is the third countermeasure.

The resistance value of the zigzag shaped heater wire ~~was~~ is about  $25\Omega$  wherein fine slits of about 0.2mm are cut on the heat generating portion 23 with an interval of about 0.4mm in a zigzag manner, on the other hand, an electrical resistance  
25 of a heater wire having the width of 2mm and length of 200mm which forms the same seal line as above ~~was~~ is  $2\Omega$ . Therefore, in the electrical point of view, the latter conventional heater wire requires ~~of of~~ about 16V and 8A, on the other hand the ~~former~~ heater wire of the present invention forming the same seal line as the conventional one requires ~~of~~ a high voltage of 50V and a low current of 2A.

30 If the commercial source voltage is 100V, it ~~is applicable~~ can be applied only by subjecting the same to halfwave rectification, further if the length of the heater wire is prolonged to 1.4 times to 280mm, the commercial source voltage of 100V can be

directly applied to the heater wire. Still further, if the commercial source voltage is 200V, when the length of the heater wire is prolonged to two times, the commercial source voltage is applicable to the heater wire after subjecting the same to halfwave rectification, however, when the width of the heater wire is modified to 3mm and the length thereof is prolonged in total to three times, the commercial source voltage of 200V can be applied as it is, thereby ~~such as a transformer and a voltage regulating circuit can be completely omitted.~~

Since ~~when~~ the zigzag shaped heater wire of the present invention is fixed while minimally expanding ~~expanded a little~~, the expansion and contraction thereof due to heat can be absorbed by the heater wire itself, the conventional complex expansion absorbing device ~~having many parts as shown in Fig. 5 is, of course, unnecessitated as well as the simple device as shown in Fig. 4 is also completely unnecessitated.~~

The reason how the gaps disappear from the seal line ~~even~~ when the heater wire includes the gaps is that the heat generated is transferred toward the gaps via the covering fluoro resin coated glass tape and the polyethylene film itself to be sealed. Therefore, if the usual thickness of 0.1 - 0.2mm is further thickened or ~~such as the~~ generated thermal amount and the generating time are increased, the gaps on the seal line will disappear even if the gap is more than 0.2mm. Further, the gap of less than 0.1mm is, of course, preferable, however, the mass production using etching will become difficult. ~~The appended claims cover these sizes of the gaps.~~ Within the defined range, a gap having a taper as shown in Fig. 11 is acceptable.

Further, it is permitted to modify the width of the heater wire, since the heat generation amount is anti-proportional to the width, through combinations with the gaps, heaters having a variety of effects can be manufactured. For example, as shown in Fig. 12, although the heater has the same or the substantially the same configuration with regard to sealing, the temperature distribution thereof is varied in such a manner that at the center portion in the width of the heat generating portion is set high and the surrounding portion thereof is set lower, thereby ~~a possible edge cutting can be prevented.~~ In fact, since heat generating density is also anti-proportional to the interval of the gaps, ~~with the measure~~ the same effect as increasing the taper of the gaps in the heater wire as shown in Fig. 11 can be obtained.

With an annealed material such as iron chromium material and nichrome alloy, a heater wire having width of even 2mm is soft and deforms during treatment thereof, if the thickness thereof is not about 0.2mm. However, these days a thin plate having thickness of 0.1mm can be manufactured by an economical rolling and when the thin plate is strengthened through a proper degree of quenching, a heat generating portion having a zigzag in the interval of 0.4mm as referred to above shows a sufficiently practical strength. However, if the tempering is too strong, the zigzagged heat generating portion is likely to break, therefore, the quenching amount has to be proper.

Since the operating temperature of the heater wire is below 200°C and is far below the quenching temperature of more than 600°C, no tempering occurs due to the heating. Further, other than the tempering a strengthening processing such as reforming by means of such as rolling and forging can be applied. To sum up, with regard to thickness of the heater wire, the thinner, the better so long as the strength thereof can be supplemented such as by tempering. The zigzag direction in the longitudinal direction as shown in the plan view in Fig. 13 can be used, however, since each zigzag length is longer, a further higher mechanical strength is required. Accordingly the strength thereof depends on the properness of its configuration design. Further, in the case of the heater having a broad area as shown in Fig. 13, any manners of covering the area with the wires and gaps are permitted and the zigzag shapes as defined in the claims cover all of these zigzag shapes. Further, other than the zigzag shape defined only by straight lines, zigzag shapes defined by curved lines are also included. ~~Further and,~~ other than the heat generating wire itself of straight line any shapes of heat generating wires, such as a curved one and one having different widths can be used.

Further, as processing methods thereof, ~~such as~~ wire cutting and laser cutting can be used. Although a heater wire is not ~~so an~~ expensive article, ~~however, if a~~ transformer can be omitted by modifying the processing of the heater wire, the heater wire can be manufactured in view of the saved cost of omitting the transformer. Accordingly, although the etching is a very economical method, the present invention is not limited thereto. Other than the zigzag shaped heat generating portion 23 formed integral with the electrode portion 4, as shown in the plan view in Fig. 14 the present invention includes an arrangement in which the zigzag portion ~~as it is~~ connected via a

width broadened connecting portion 25 to the electrode portion 4 through spot welding.

Further, the sealer pressing mechanism of the present invention includes a pressing operation via a worker wherein the worker grips a T shaped hand type handle being provided with a heater at one side thereof by the hand and performs heat sealing by pressing the same on polyethylene placed on a work stand. Further, since the present heater can be operated while omitting the voltage regulator ~~therefor, in such instance,~~ the power source circuit implies a simple current supply from the power source to the heater. Further, since the impulse sealer of the present invention is ~~light weight~~ lightweight and can be directly coupled to a power source, the present impulse sealer can be actively used in a field where only heating plate type heaters are conventionally used.

The above can also be applied to a book binding machine and a laminator using such heating plate type heater and the impulse heat sealer of the present type can be applied therefor. Namely, a fluoro resin tape is covered on a zigzag shaped heater wire which is shaped into a necessary configuration, with a press mechanism incorporating the same such as a bundle of paper for book binding and laminated films are pressed, a comparatively large current is fed thereto for a short time to heat the same and is interrupted to cool the same, thereby an adhesive of such as heat meltable resin is melted and adhered. For example, since the zigzag shaped heater wire can be shaped in a rectangular shape, such heater wire is suitable for laminating a photo for an identification card. Such heater can be used any time when desired, moreover, such heater is not required to be always heated ~~always~~ which contributes to energy saving. The heating equipment such as the impulse heat sealer as defined in the claims includes the above referred to book a binding machine and laminator.

#### Industrial Applicability of the Invention

According to the present invention, since the heater wires ~~are~~ can be formed by making use of ~~such as~~ photoetching, heater wires of any configurations can be manufactured accurately in large amount and with low cost, in addition, causes of shortening life time of the heater wire such as overheating due to poor spot welding is eliminated.

Since the electrode portions are formed thin as the heat generating portion, the electrode portions can be extended over on the heater stand, the undesirable formation of penetration holes on a processing subject due to overheating because of the floating in air of a part of the heat generating portion which likely happens at both ends of the conventional extension absorbing device is prevented.

Further, since the zigzag shape of the heater wire is formed with narrow slits which cause to disappear the slit gaps on the seal line, the voltage to be applied to the heat generating portion can be approximated to the voltage of the power source, thereby, a voltage regulator such as a transformer is unnecessitated and the structure thereof is simplified. Because the heavy transformer is omitted, the weight of the present device becomes very light and the cost thereof is lowered.

Further, since a possible distortion due to thermal expansion can be absorbed by the spring property of the heater wire itself and the zigzag shaped heat generating portion further enhances the distortion absorbing effect, thereby, the extension absorbing devices which usually have to be provided at the both ends of the heater wire can be simplified or unnecessitated.

Thus, the impulse heat sealer itself can be easily manufactured and the cost thereof can be lowered extremely.

Further, by making use of the heater wire of the present invention, an impulse heat sealer type book binding machine and laminator can be manufactured, and the present heater wire can be used instantly which contributes to energy saving.

Although the present invention has been described with reference to specific embodiments, those of skill in the art will recognize that changes may be made thereto without departing from the spirit and scope of the invention as set forth in the hereafter appended claims.

#### **In the Claims:**

Claims 1-5 have been amended as follows:

1. (Amended) An impulse heat sealer ~~and a heater wire therefore which comprises~~comprising: at least

a power source circuit, a heater connected thereto and a press mechanism incorporating the heater, wherein by feeding a comparatively large current

from the power source circuit for a short time to the heater including a heater wire, the heater wire being ~~which is~~ covered by ~~such as~~ a fluoro resin coated glass tape, to heat the ~~same~~ heater and by interrupting the ~~same~~ comparatively large current for cooling, ~~such as~~ polyethylene and a heat meltable resin caught in the press mechanism is melted and adhered; and

~~characterized in that the heater wire is formed in such a manner that comprising~~ a thin plate of electrically high resistance metal, ~~such as iron chromium which the thin plate of electrically high resistance metal is~~ thinned ~~and extremely by means of such as rolling and is properly strengthened, such as by tempering is~~ and the heater wire is processed such as by photoetching in such a configuration that the width of an electrode portion or a portion which ~~is required to suppresses~~ heat generation is broadened so far as permitted by the electrically high resistance metal, and a heat generating portion is shaped into a desired configuration with a narrow uniform width, then the both portions are integrated so as to form a self independent body.

2. (Amended) An impulse heat sealer ~~heater wire~~ according to Claim 1, ~~characterized in that~~ wherein the heater wire, in order to prevent swelling of a seal line or a plane to a side of ~~such as~~ a main body of a polyethylene bag caught in the press mechanism and the breakage thereof should be prevented, ~~the heater wire is~~ configured in such a manner that either the width broadened portion of the electrode portions at the side facing to the main body is eliminated or when the broadened portions are provided at both sides of the electrode portions, the broadened portions facing the main body is retreated further away in comparison with another broadened portion at the opposite bag edge side.

3. (Amended) An impulse heat sealer, according to Claim 1, ~~wherein characterized in that the impulse heat sealer is structured in such a manner that~~ the heat generating portions of a single or a plurality of heater wires are arranged to come close within a plurality of small gaps of certain degree formed by itself or with the others heater wires to ~~thereby~~ gather the heat generated together through heat diffusion at a resultant seal line or a plane to disappear the gaps.



4. ~~(Amended) An impulse heat sealer-heater wire~~ according to Claim 1, ~~characterized in that~~ wherein the heater wire is configured in a zigzag shape with a small gap which is caused to disappear through heat diffusion on a resultant seal line or a plane, and is spread over a desired configuration for the heat generating portion.

5. (Amended) A book binding machine and laminator comprising which ~~comprises at least~~

a power source circuit, a heater connected thereto and a press mechanism incorporating the heater, ~~characterized in that the heater~~ including is formed by combining a heater wire such as covered by a fluoro resin coated glass tape;

10 the heater wire is ~~formed in such a manner that~~ comprising a thin plate of electrically high resistance metal, ~~such as iron chromium~~ the thin plate of electrically high resistance metal is ~~which is thinned extremely by means of such as rolling and is properly and strengthened, the heater wire such as by tempering~~ is processed to form an electrode portion or a portion which is ~~required to suppresses~~ heat generation having a broadened width so far as permitted by the electrically high resistance metal and a heat generating portion formed into a zigzag shape with a narrow uniform width and with a small gap which disappears heating unevenness at a resultant sealed portion through heat diffusion and covering over an entire desired configuration thereof; and

15 the heater is heated by being fed a comparatively large current from the power source for a short time and is cooled by interrupting the ~~same~~ comparatively large current, and using ~~thereby, by making use of such as~~ polyethylene and a heat meltable resin caught in the press mechanism as adhesive such as book binding use paper sheets and laminate use films are melt-adhered.

25 Claims 6-12 have been added.

6. An impulse heat sealer according to Claim 1, wherein the thin plate of electrically high resistance metal is thinned by a rolling means.

7. An impulse heat sealer according to Claim 1, wherein the thin plate of electrically high resistance metal is strengthened by a tempering means.

8. An impulse heater sealer according to Claim 1, wherein the heater wire is processed by a photoetching means.

9. An impulse heater sealer according to Claim 1, wherein the thin plate of electrically high resistance metal is iron chromium.

5 10. A book binding machine and laminator according to Claim 5, wherein the thin plate of electrically high resistance metal is thinned by a rolling means.

11. A book binding machine and laminator according to Claim 5, wherein the thin plate of electrically high resistance metal is strengthened by a tempering means.

10 12. A book binding machine and laminator according to Claim 5, wherein the thin plate of electrically high resistance metal is iron chromium.

## ABSTRACT

A heater wire which is applied to an impulse heat sealer, a book binding machine, a laminator, an image-creating device, and so on. A thin sheet of resistant material such as iron-chromium alloy is further thinned by rolling, properly strengthened by quenching, and processed by photo-etching so that the width of a heat-  
5 generating part is small and those of the electrodes are larger than that, thus integrally producing a heater wire. The heat-generating part of the heater wire is zigzag at such small intervals that the zigzag pattern disappears on a sealing line or plane because of heat diffusion, and the width of the zigzag is uniformly narrow and almost equal to  
10 that of the required shape. Therefore, the drawback on connection between the heat-generating part and electrodes is solved and the resistant wire is matched with the power supply voltage because of its relatively fine and long structure.

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## Specification

## Heater Wire for Device such as Impulse Sealer

## Technical Field

The present invention relates to an impulse sealer, a book binding machine and a laminator which thermally melt and adhere such as polyethylene.

## Background Art

An impulse heat sealer is caused to flow a current of 8-15A through a heater wire having a width of about 2 ~ 5mm, heats to about 150°C for a short period of about one second and melts and adheres polyethylene and thermally meltable resin, and with regard to the heater wire a heat generating portion therefor uses a narrow width wire member having a high electrical resistance such as iron chromium and nichrome, and an electrode portion which requires no heat generation uses such as a comparatively thick plated copper plate and iron plate, and the both are connected such as by press contacting and spot welding.

Although a large current flows through the sealer, since the length of the sealer is about 20 ~ 40 cm, a voltage which appears at the both ends thereof merely reaches to about 15 ~ 30V. For this reason, the commercial power source voltage of 100 ~ 220V had to be adjusted by making use of a voltage regulator

such as a transformer and an electronic circuit.

Since such as the press contacting and the spot welding of the heater wires is a manual work which requires senses, and causes irregular length thereof, defective products and lack of accuracy, and which tends to cause overheating of the connected portion and shortening the lifetime thereof.

Further, the electrode such as press contacted and spot welded has a substantial thickness, the thick electrode portion could not be mounted on a heater stand, therefore, when a conventional expansion absorbing device 15 as shown in Fig. 5 is used and the heat generation portion is extended, the both ends thereof float in air and are overheated, therefore, it is frequently happened that holes are caused in such as polyethylene over the over heated portions.

Further, the transformer is very heavy, and with regard to the voltage regulator in the form of the electronic circuit since the voltage thereof is comparatively low in comparison with the power source voltage and the current thereof is large, the control thereof is difficult and fault likely occurs, and further the prices of these two components were high.

In such as the bookbinding machine and the laminator such as metallic bar and a roll having a large thermal capacity are heated by a heater which is formed by winding a nichrome wire around such as a mica plate and are used under a thermal

equilibrium state thereof. Therefore, even if the amount for a processing is slight, it is required to wait for from 5 to 10 minutes until the metallic bar or the roll are heated.

As a prior art of the present invention, JP(U)-A-57-167004 (hereinbelow will be referred to as citation) is located. The citation discloses a zigzag shaped heater wire which is formed by cutting slits on a tape shaped metallic layer pasted on a glass epoxy resin substrate from both sides thereof alternatively in perpendicular direction to its longitudinal direction, and of which configuration is very similar to the present invention. However, the objects of the citation are to prevent braking of the heater wire due to force of a thermal expansion use spring, to eliminate a transformer by narrowing a broad width heater wire and to enhance heat dissipation property, and is silent to eliminate the zigzag shape on a seal line by decreasing a gap of the respective slits and never refers to such object.

With regard to the gap size, the citation indicates that the gap size is about three times larger than the thickness of the metallic layer. Since the thickness thereof in an embodiment of the citation is 0.1mm, the gap will be 0.3mm. Although an iron chrome thin plate with no tempering having thickness of 0.1mm cannot maintain of its given shape. However, since the heater wire according to the present invention the

shape can be maintained without trouble, an experiment was performed thereon in such a manner while covering a teflon coated glass tape of 0.1mm over the thus produced heater wire, the heater wire was heat sealed according to the embodiment, however, gaps clearly appeared on a seal line. If a metallic wire with no tempering is used, thickness of 0.2mm is required, then according to the citation the gap will amount to 0.6mm in such instance the gaps will further clearly appear on the seal line.

Therefore, the disclosure in the citation "the seal width is 5mm corresponding to the width of rectangular pulse wave as shown in Fig. 1" likely possibly suggests that the seal line is in a zigzag shape as it is, however, if the gaps on the seal line disappear, it is presumed that such will be caused by the heat accumulated therearound including a substrate, because the citation indicates that the scaling time is 4 seconds which is 4 ~ 8 times longer than a sealing time of 0.5 - 1 second of a usual sealer, on one hand it is presumed that such is because of a poor heat dissipation which is contrary to the original object of the citation, anyway the citation nowhere suggests that the gaps should be limited as much as possible.

Further, in the citation, it is necessary to keep the shape of the metallic plate by adhering the same on a glass epoxy resin substrate, however, in order to reduce cost in mass

production with regard to metallic portions photo exposure and etching is performed over a broad area, therefore, the citation raises a lot of problems and includes unsolved problems as follows. How the glass epoxy resin substrate is cut? Whether the heat resisting property of the epoxy resin substrate can be maintained because the operation temperature of the sealer for such as PP rises to more than 150°C. What sort of adhesives having durability is used? Whether the heat dissipation property due to the closely contacted substrate is deteriorated as referred to above? Whether the sealing time is prolonged because of the heat absorption by the substrate? How the both ends of the lead wire portion can be taken out to the outside in a flat state because the both ends of the lead wire portion also serve as the pressing faces.

#### Disclosure of the Invention

A heater wire is formed in such a manner that a thin plate of resistance material such as iron chromium is further thinned extremely by means of such as rolling and is properly strengthened such as by tempering, thereafter the same is processed such as by photo etching, then the width of electrode portion a portion which is required to suppress heat generation is broadened so far as permitted, a heat generating portion is shaped into a desired configuration with a narrow uniform width,



then the both portions are integrated.

Further, a measure is applied to the electrode portion which eliminates a drawback of swelling a seal line.

Further, the heater wire is formed in a zigzag shape of narrow uniform width over the entire desired configuration of the heat generation portion while using small gaps which disappear due to heat diffusion from the formed seal line or plane.

Still further, by making use of the heater wire impulse type bookbinding machine and laminator are produced in which heating is performed instantaneously to melt an adhesive on an inside resin and then interrupts the current supply to cool the same.

#### Brief Description of the Drawings

Figs. 1 through 3 are plane views of a variety of heater wires of the present invention and of a variety of seal lines in that the formed melting and adhering traces through sealing, Fig. 4 is a side view showing an expansion absorbing structure of a heater wire caused by itself, Fig. 5 is a side view of a conventional expansion absorbing structure, Figs. 6 and 7 are plane views showing application examples of the heater wire of the present invention and Fig. 8 is a plane view showing heater wires for a bag with a cat pattern.

Fig. 9 is a plane view showing a zigzag shaped heater wire and the seal line formed thereby, Figs. 10 through 12 are enlarged plane views of heat generating portions thereof, Fig. 13 is a plane view showing another heater wire and Fig. 14 is a plane view showing a connecting portion with a heater wire.

#### Best Modes for Carrying Out the Invention

Fig. 1 is a plane view of a heater wire 1 and its seal line 2 in an example of the present invention. The heater wire 1 includes a heat generating portion 3 having width of 2mm and electrode portions 4 having width of 5mm which are formed from a same plate member by photo etching in such a manner that on a thin plate which is formed by rolling an iron chromium material into 0.1mm and is adjusted into a proper hardness a photosensitive material is coated in advance, after photo-masking a pattern the coated photosensitive material is exposed and fixed, thereafter, further covering a necessary portion with a film and dissolving and removing unnecessary portions by acid to complete the same. As in the present electrode portions even if a same resistance material is used, when the width of the electrode portions is broadened more than about two times, it can be controlled no sealing is effected at the portions.

When the heater is used for household use in which number

of its use is small, no problems occur, however, the heater is used continuously in a certain extent the heat in the heat generating portion gradually spreads into the electrode portions 4, swellings 5 are formed in the seal line 2 of the heater wire 1 due to width expansion of the electrode portions 4 at both ends thereof. If a force applied to a bag is concentrated on to the swelling 5, the seal is likely broken. There are three countermeasures therefor.

The first countermeasure is to place a heat absorbing electrode plates 6 at the positions of the electrode portions 4 so as to overlap therewith as shown in Fig. 2, thereby, the heating is stopped at their overlapping portions as shown by the seal line 7, the heat absorbing electrode plate 6 which is disclosed in Japanese Patent Application No. Heisei 8-346654 is a thin plate of such as nickel plated phosphor bronze and alloy materials having good electrical and, in particular, thermal conductive property can be used therefor. Drawbacks of this measure are to increase number of parts correspondingly and, because of current flow between the heat generating portions 3 and the heat absorbing electrode plates 6, to consume the heater wire comparatively rapidly at their contacting portions.

A second countermeasure is, in order to prevent swelling of the seal line at the side of the bag main body, either to

offset the heat generating portion 3 from the center, to eliminate the width broadened portion 8 at the side of the bag main body and to double the width at the opposite side or as shown in Fig. 3 to retreat the width broadened portions near to the both ends as illustrated in comparison with the width broadened portion 9 at the opposite side, which forms the side of the bag edges. In this instance, although the swelling 11 on the seal line is formed which only appears at the side of the bag edges. The above indication of at the sides of the bag main body and of at the bag edges is, of course, only one of standards which implies that the swellings are aligned at one wide where the adversary influence is small.

The same effect can be obtained if the heater wire 1 is bent perpendicularly along the broken lines 12 in Fig. 3. This is for preventing unnecessary elongation of the sealer. When the electrode portion 4 is bent perpendicularly as illustrated by the side view in Fig. 4, a pillow shaped projection 14 is placed before the fixing screw 13 to apply a tension thereto, the elongation of the heat generating portion caused during the heating is sufficiently absorbed by the electrode portion through the spring property of itself, thereby, the conventional complex elongation absorbing device 15 having many parts is unnecessitated.

The heat generating portion 3 can be formed in any shapes

other than the straight line. An elliptical heater wire 16 as shown in Fig. 6 is for a molding handle of a polyethylene shopping bag and a rectangular heater wire 17 as shown in Fig. 7 is for sealing an outer frame of a bag shaped filter. Further, the heater wire 17 is required to form a closed space by the rectangular seal line, therefore, if the gap at a nearby portion 18 is set below 0.2mm, the gap on the seal line will disappear.

Such relationship between gap and seal line occurs in any heater wires. Fig. 8 shows heaters for a shopping bag with an inflatable cat head which is used through experience for balloon manufacturing method disclosed in U.S. Patent No. 5,545,117, wherein a heater wire 20 of nichrome round wire is for sealing and burning off the outer configuration, likely, a heater wire 21 is for simply sealing in order to separate the cat head from the inside of the shopping bag and copper wires are connected along dotted portions 22 at both ends thereof so as to prevent heat generation. The heater is formed in such a manner that after arranging these round wires into a desired configuration, these are caught by such as a fluoro resin coated glass cloth with adhesive to fix the same. The cat face and the handle are illustrated to facilitate understanding of the above explanation.

At this instance, at the portions where the two heater wires come most close, in that at two portions at root portion

of ear and jaw portion, it is necessary to keep air tight, therefore, the heater wire 21 is closely contacted at the portions by adhering such as a glass tape having thickness of about 0.1mm but electrically insulating from the other. Because of adhering the tape at the portions, the sealing temperature tends to lower, however, since the heater wires are closely located, much tendency is cancelled out, further, through controlling the supply current, the above arrangement is operated sufficiently practical and it was found out that no air leakage gap was formed in the resultant seal line.

A heater wire which makes use of the above is one shown in Fig. 9, in which the width of the resistance material is narrowed and fine slits are cut in a heat generating portion 23 to form a uniform zigzag in perpendicular direction in the longitudinal direction thereof, and Figs. 10 through 12 are partially enlarged views thereof. When these heater wires are used and if the slits are sufficiently small, a beautiful single seal line 24 as illustrated can be obtained. Further, the zigzag is interrupted immediately before the electrode portions at the both ends and is restored to the original width, no problematic end swellings appear on the seal line 24, which is the third countermeasure.

The resistance value of the zigzag shaped heater wire was about 25Ω wherein fine slits of about 0.2mm are cut on the heat

generating portion 23 with an interval of about 0.4mm in a zigzag manner, on the other hand, an electrical resistance of a heater wire having the width of 2mm and length of 200mm which forms the same seal line as above was 2Ω. Therefore, in the electrical point of view, the latter conventional heater wire requires of about 16V and 8A, on the other hand the former heater wire of the present invention forming the same seal line as the conventional one requires of a high voltage of 50V and a low current of 2A.

If the commercial source voltage is 100V, it is applicable only by subjecting the same to halfwave rectification, further if the length of the heater wire is prolonged to 1.4 times to 280mm, the commercial source voltage of 100V can be directly applied to the heater wire. Still further, if the commercial source voltage is 200V, when the length of the heater wire is prolonged to two times, the commercial source voltage is applicable to the heater wire after subjecting the same to halfwave rectification, however, when the width of the heater wire is modified to 3mm and the length thereof is prolonged in total to three times, the commercial source voltage of 200V can be applied as it is, thereby such as a transformer and a voltage regulating circuit can be completely omitted.

Since when the zigzag shaped heater wire is fixed while expanding a little, the expansion and contraction thereof due

to heat can be absorbed by itself, the conventional complex expansion absorbing device having many parts as shown in Fig. 5 is, of course, unnecessitated as well as the simple device as shown in Fig. 4 is also completely unnecessitated.

The reason how the gaps disappear from the seal line even when the heater wire includes the gaps is that the heat generated is transferred toward the gaps via the covering fluoro resin coated glass tape and the polyethylene film itself to be sealed. Therefore, if the usual thickness of 0.1 - 0.2mm is further thickened or such as the generated thermal amount and the generating time are increased, the gaps on the seal line will disappear even if the gap is more than 0.2mm. Further, the gap of less than 0.1mm is, of course, preferable, however, the mass production using etching will become difficult. The appended claims cover these sizes of the gaps. Within the defined range, a gap having a taper as shown in Fig. 11 is acceptable.

Further, it is permitted to modify the width of the heater wire, since the heat generation amount is anti-proportional to the width, through combination with the gaps heaters having a variety of effects can be manufactured. For example, as shown in Fig. 12, although the heater has the same or the substantially the same configuration with regard to sealing, the temperature distribution thereof is varied in such a manner that at the center portion in the width of the heat generating portion is



set high and the surrounding portion thereof is set lower, thereby a possible edge cutting can be prevented. In fact, since heat generating density is also anti-proportional to the interval of the gaps, with the measure the same effect as increasing the taper of the gaps in the heater wire as shown in Fig. 11 can be obtained.

With an annealed material such as iron chromium material and nichrome alloy, a heater wire having width of even 2mm is soft and deforms during treatment thereof, if the thickness thereof is not about 0.2mm. However, these days a thin plate having thickness of 0.1mm can be manufactured by an economical rolling and when the thin plate is strengthened through a proper degree of quenching, a heat generating portion having a zigzag in the interval of 0.4mm as referred to above shows a sufficiently practical strength. However, if the tempering is too strong, the zigzagged heat generating portion is likely to break, therefore, the quenching amount has to be proper.

Since the operating temperature of the heater wire is below 200°C and is far below the quenching temperature of more than 600°C, no tempering occurs due to the heating. Further, other than the tempering a strengthening processing such as reforming by means of such as rolling and forging can be applied. To sum up, with regard to thickness of the heater wire the thinner, the better so long as the strength thereof can be supplemented

such as by tempering. The zigzag direction in the longitudinal direction as shown in the plan view in Fig. 13 can be used, however, since each zigzag length is longer, a further higher mechanical strength is required. Accordingly the strength thereof depends on properness of its configuration design. Further, in the case of the heater having a broad area as shown in Fig. 13, any manners of covering the area with the wires and gaps are permitted and the zigzag shapes as defined in claims cover all of these zigzag shapes. Further, other than the zigzag shape defined only by straight lines zigzag shapes defined by curved lines are also included. Further, other than the heat generating wire itself of straight line any shapes of heat generating wires such as curved one and one having different widths can be used.

Further, as processing methods thereof such as wire cutting and laser cutting can be used. Although a heater wire is not so expensive article, however, if a transformer can be omitted by modifying the processing of the heater wire, the heater wire can be manufactured in view of the saved cost of omitting the transformer. Accordingly, although the etching is a very economical method, the present invention is not limited thereto. Other than the zigzag shaped heat generating portion 23 formed integral with the electrode portion 4, as shown in the plan view in Fig. 14. the present invention includes an arrangement in

which the zigzag portion as it is is connected via a width broadened connecting portion 25 to the electrode portion 4 through spot welding.

Further, the sealer pressing mechanism of the present invention includes a pressing operation via a worker wherein the worker grips a T shaped hand type handle being provided with a heater at one side thereof by the hand and performs heat sealing by pressing the same on polyethylene placed on a work stand. Further, since the present heater can be operated while omitting the voltage regulator therefor, in such instance, the power source circuit implies a simple current supply from the power source to the heater. Further, since the impulse sealer of the present invention is light weight and can be directly coupled to a power source, the present impulse sealer can be actively used in a field where only heating plate type heaters are conventionally used.

The above can also be applied to a book binding machine and a laminator using such heating plate type heater and the impulse heat sealer of the present type can be applied therefor. Namely, a fluoro resin tape is covered on a zigzag shaped heater wire which is shaped into a necessary configuration, with a press mechanism incorporating the same such as bundle of paper for book binding and laminated films are pressed, a comparatively large current is fed thereto for a short time to

heat the same and is interrupted to cool the same, thereby an adhesive of such as heat meltable resin is melted and adhered. For example, since the zigzag shaped heater wire can be shaped in a rectangular shape, such heater wire is suitable for laminating a photo for an identification card. Such heater can be used any time when desired, moreover, such heater is not required to be heated always which contributes to energy saving. The heating equipment such as the impulse heat sealer as defined in the claims includes the above referred to book binding machine and laminator.

#### Industrial Applicability of the Invention

According to the present invention, since the heater wires are formed by making use of such as photoetching, heater wires of any configurations can be manufactured accurately in large amount and with low cost, in addition, causes of shortening life time of the heater wire such as overheating due to poor spot welding is eliminated.

Since the electrode portions are formed thin as the heat generating portion, the electrode portions can be extended over on the heater stand, the undesirable formation of penetration holes on a processing subject due to overheating because of the floating in air of a part of the heat generating portion which likely happens at both ends of the conventional extension absorbing device is prevented.

Further, since the zigzag shape of the heater wire is formed with narrow slits which cause to disappear the slit gaps on the seal line, the voltage to be applied to the heat generating portion can be approximated to the voltage of the power source, thereby, a voltage regulator such as a transformer is unnecessary and the structure thereof is simplified. Because the heavy transformer is omitted, the weight of the present device becomes very light and the cost thereof is lowered.

Further, since a possible distortion due to thermal expansion can be absorbed by the spring property of the heater wire itself and the zigzag shaped heat generating portion further enhances the distortion absorbing effect, thereby, the extension absorbing devices which usually have to be provided at the both ends of the heater wire can be simplified or unnecessary.

Thus, the impulse heat sealer itself can be easily manufactured and the cost thereof can be lowered extremely.

Further, by making use of the heater wire of the present invention, an impulse heat sealer type book binding machine and laminator can be manufactured, and the present heater wire can be used instantly which contributes to energy saving.

## Scope of Claims

1. (Amended) An impulse heat sealer and a heater wire therefor which comprises at least a power source circuit, a heater connected thereto and a press mechanism incorporating the heater, wherein by feeding a comparatively large current from the power source circuit for a short time to the heater including a heater wire which is covered by such as fluoro resin coated glass tape to heat the same and by interrupting the same for cooling, such as polyethylene and a heat meltable resin caught in the press mechanism is melted and adhered, characterized in that the heater wire is formed in such a manner that a thin plate of electrically high resistance metal such as iron chromium which is thinned extremely by means of such as rolling and is properly strengthened such as by tempering is processed such as by photoetching in such a configuration that the width of electrode portion or a portion which is required to suppress heat generation is broadened so far as permitted, a heat generating portion is shaped into a desired configuration with a narrow uniform width, then the both portions are integrated so as to form a self independent body.
2. A heater wire according to Claim 1, characterized in that in order to prevent swelling of a seal line or plane to a side of such as a main body of a polyethylene bag caught

in the press mechanism and the breakage thereof should be prevented, the heater wire is configured in such a manner that either the width broadened portion of the electrode portions at the side facing to the main body is eliminated or when the broadened portions are provided at both sides of the electrode portions, the broadened portions facing the main body is retreated further away in comparison with another broadened portion at the opposite bag edge side.

3. (Amended) An impulse heat sealer, characterized in that the impulse heat sealer is structured in such a manner that heat generating portions of a single or a plurality of heater wires are arranged to come close within small gaps of certain degree formed by itself or with the others to thereby gather the heat generated together through heat diffusion at a resultant seal line or plane to disappear the gaps.
4. A heater wire according to Claim 1, characterized in that the heater wire is configured in a zigzag shape with a small gap which is caused to disappear through heat diffusion on a resultant seal line or plane, and is spread over a desired configuration for the heat generating portion.
5. (Amended) A book binding machine and laminator which comprises at least a power source circuit, a heater connected thereto and a press mechanism incorporating the heater, characterized in that the heater is formed by

combining a heater wire such as by a fluoro resin coated glass tape, the heater wire is formed in such a manner that a thin plate of electrically high resistance metal such as iron chromium which is thinned extremely by means of such as rolling and is properly strengthened such as by tempering is processed to form an electrode portion or a portion which is required to suppress heat generation having broadened width so far as permitted and a heat generating portion formed into a zigzag shape with a narrow uniform width and with a small gap which disappears heating unevenness at a resultant sealed portion through heat diffusion and covering over an entire desired configuration thereof, the heater is heated by being fed a comparatively large current from the power source for a short time and is cooled by interrupting the same, thereby, by making use of such as polyethylene and a heat meltable resin caught in the press mechanism as adhesive such as book binding use paper sheets and laminate use films are melt-adhered.



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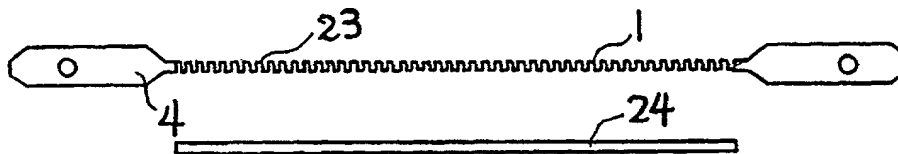
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(54) Title: HEATER WIRE FOR DEVICE SUCH AS IMPULSE HEAT SEALER

(54) 発明の名称: インパルスヒートシーラー等のヒーター線



(57) Abstract: A heater wire which is applied to an impulse heat sealer, a bookbinding machine, a laminator, an image-creating device, and so on. A thin sheet of resistant material such as an iron-chromium alloy is further thinned by rolling, properly strengthened by quenching, and processed by photoetching so that the width of a heat-generating part is small and those of the electrodes are larger than that, thus integrally producing a heater wire. The heat-generating part of the heater wire is zigzag at such small intervals that the zigzag pattern disappears on a sealing line or plane because of heat diffusion, and the width of the zigzag is uniformly narrow and almost equal to that of the required shape. Therefore, the drawback on connection between the heat-generating part and electrodes is solved and the resistant wire is matched with the power supply voltage because of its relatively fine and long structure.

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Fig. 1

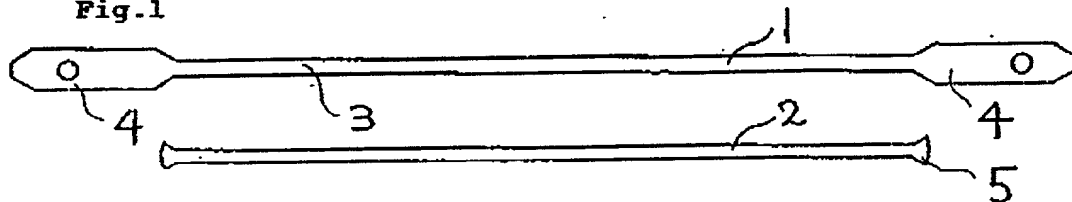


Fig. 2

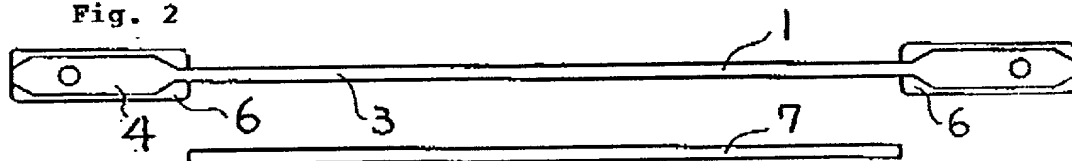


Fig. 3

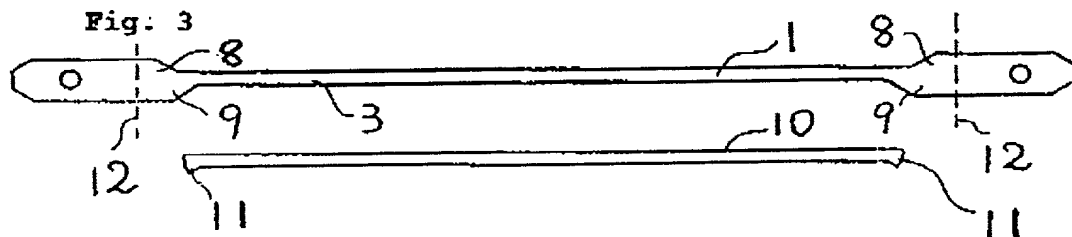


Fig. 4

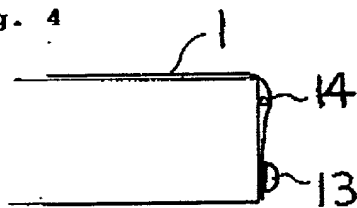


Fig. 5

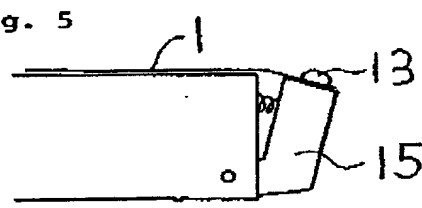


Fig. 6

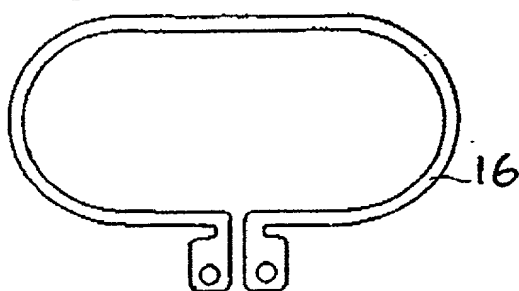
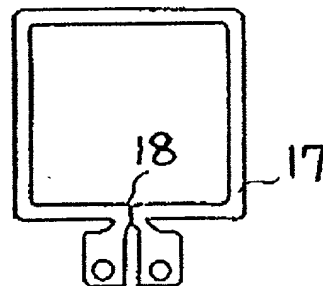


Fig. 7



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Fig. 8

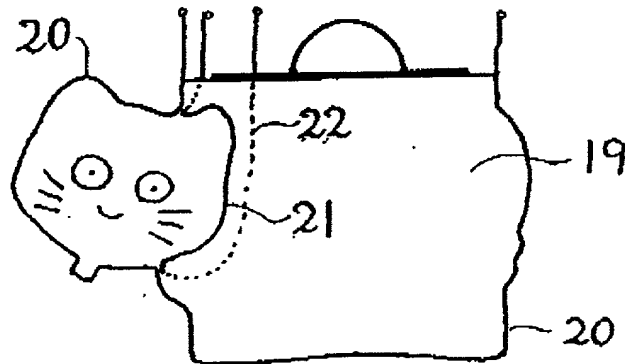


Fig. 9

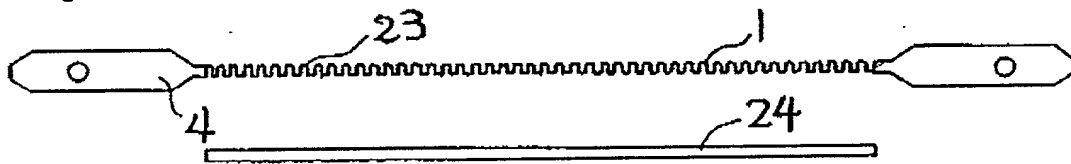


Fig. 10



Fig. 11



Fig. 12

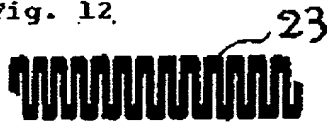


Fig. 14

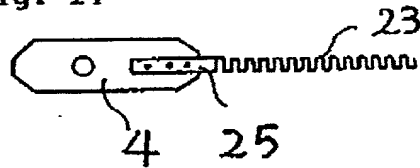
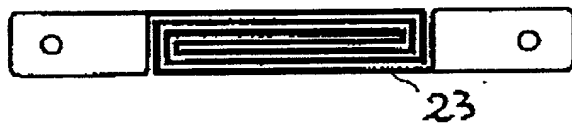


Fig. 13



Docket No.  
0112895-005

# 5

# Declaration and Power of Attorney For Patent Application

## English Language Declaration

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

**HEATER WIRE FOR DEVICE SUCH AS IMPULSE HEAT SEALER**

the specification of which

(check one)

☐ is attached hereto.

☒ was filed on January 7, 2000 as United States Application No. or PCT International

Application Number PCT/JP00100035

and was amended on \_\_\_\_\_

(if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d) or Section 365(b) of any foreign application(s) for patent or inventor's certificate, or Section 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)

Priority Not Claimed

H11-199410

JAPAN

9 JUNE 1999

☐

(Number)

(Country)

(Day/Month/Year Filed)

☐

(Number)

(Country)

(Day/Month/Year Filed)

☐

(Number)

(Country)

(Day/Month/Year Filed)

I hereby claim the benefit under 35 U.S.C. Section 119(e) of any United States provisional application(s) listed below:

\_\_\_\_\_  
(Application Serial No.)

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(Filing Date)

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(Application Serial No.)

\_\_\_\_\_  
(Filing Date)

\_\_\_\_\_  
(Application Serial No.)

\_\_\_\_\_  
(Filing Date)

I hereby claim the benefit under 35 U. S. C. Section 120 of any United States application(s), or Section 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. Section 112, I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, C. F. R., Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

\_\_\_\_\_  
(Application Serial No.)

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(Filing Date)

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(Status)  
(patented, pending, abandoned)

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(Application Serial No.)

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(Filing Date)

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(patented, pending, abandoned)

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(Status)  
(patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (list name and registration number)



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